

## **APPENDIX E**

### **STANDARD OPERATING PROCEDURES**

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## **STANDARD OPERATING PROCEDURE NO. 1**

### **Chain-of-Custody Procedures**

Scope: This procedure describes the Chain-of-Custody used to establish the necessary documentation to track sample possession from time of collection to analysis.

Purpose: The purpose of this procedure is to develop and maintain good quality control in field operations, uniformity between field personnel involved in the documentation of samples for shipment.

Equipment: Chain-of-Custody Record and Chain-of-Custody Seals

#### **PROCEDURE:**

Prior to leaving the sampling site and/or prior to sealing sample cartons or coolers for shipment, the Chain-of-Custody Record must be completed.

Information to be provided on this form includes:

1. Project number and Location
2. Laboratory Identification
3. Sampling Party
4. Sample Identification (sample number)
5. Sample Bottle/Container Description
6. Date of Sampling
7. Signature of Persons including Chain-of-Custody and Dates and Times of Possession
8. Delivery Method (attach shipping bill)

Once the container is ready for shipment, Chain-of-Custody Seals shall be applied to the cooler in such a manner as to monitor tampering.

Upon change of possession, the record is to be signed and dated by both parties. The white (original) copy accompanies the shipment, the field sampler retains the yellow copy.

## **STANDARD OPERATING PROCEDURE NO. 2**

### **Sample Packaging and Shipment**

**Scope:** This procedure describes acceptable methodology for packaging and shipping environmental samples to an analytical laboratory for chemical analyses.

**Purpose:** The purpose of this procedure is to provide a uniform and documented means of securely transporting environmental samples to the laboratory so as to preserve the integrity and quality of the sample(s).

**Equipment:** Packaging tape, mailing labels, chain-of-custody forms, chain-of-custody seals, shipping forms, ice, insulated cooler(s), laboratory task order amendment form.

#### **PROCEDURES:**

1. Assemble all sample containers from the completed sampling event.
2. Locate, identify and record all types of containers for each sample identification number on a chain-of-custody form.
3. Subtotal the number of containers of similar types and then add them all together to get a total bottle count. Check similar bottle counts and total bottle counts with the samples present.
4. Check to make sure bottles were labeled properly and have protective tape over them.
5. Package volatile organic vials (40 mL glass with teflon-septa caps) in pairs by wrapping them in paper towels and securing them with a rubber band. Then place the pairs in plastic zip-lock bags.
6. Secure glass bottles in foam packaging material.
7. Place some shock absorbing material in the bottom of the cooler to prevent direct contact of the glass bottles with the bottom of the cooler.
8. Arrange bottles in cooler to prevent movement. Plastic bottles can fit in between other bottles to make the cooler contents stable.

## **STANDARD OPERATING PROCEDURE NO. 2**

### **Sample Packaging and Shipment (Cont.)**

9. Place ice in a sealable bag and then put that bag in another one to prevent leakage. Place the bag of ice on the top of the samples.
10. Place the top copy of the chain-of-custody in a sealable bag and secure, along with a laboratory task order amendment form if needed, to the top of the cooler with tape.
11. Close lid and place custody seals over the lid/cooler joint and cover with clear tape so as to encircle the entire cooler.
12. Properly complete and address a shipping form and affix to the lid of the cooler. Samples should be delivered to the laboratory by the next morning.
13. Deliver to an appropriate overnite courier or the laboratory.
14. File a copy of the chain-of-custody form and the shipping form in the project file.
15. Call laboratory the next morning to confirm arrival of samples.

## **STANDARD OPERATING PROCEDURE NO. 3**

### **Soil Sampling from Geoprobe® Borings**

**Scope:** The operating procedure describes the ways and means of obtaining a soil sample from boring via a Geoprobe® large-core sampler.

**Purpose:** The purpose of this procedure is to assure good quality control in field operations, uniformity between different field personnel and to allow traceability of possible cause of errors in analytical results.

**Equipment:** Geoprobe® large-core sampler, polyethylene soil core liners, tape measure, hand lens, sample/core log, log book, sample containers with labels, chain-of-custody record, knife or trowel, disposable gloves, plastic sheeting, and decontamination equipment.

#### **PROCEDURE:**

1. Place sheeting down near borehole.
2. Position Geoprobe® drive assembly over the point to be sampled.
3. Hammer sampler as detailed in Geoprobe® sampling literature.
4. Remove the large-core sampler and extract the sample by cutting open the polyethylene core liner.
5. For volatile organics, immediately transfer soil to a sample jar, leave no head space, and tightly cap.
6. Examine and record sample description on sample/core log sheet in accordance with description procedure for particular project. Make special note of any obviously contaminated zones.
7. Homogenize remaining soil with stainless steel bowl and spoon and fill remaining sample containers for chemical analysis and/or physical parameter testing, as needed.
8. Label samples, complete remaining information on field forms, and record information on a chain-of-custody record.
9. Store samples in coolers with ice at 4°C .

### **STANDARD OPERATING PROCEDURE NO. 3**

#### **Soil Sampling from Geoprobe® Borings (Cont.)**

10. Decontaminate Geoprobe® large-core sampler by dry brushing, followed by a Micro solution wash, followed by a rinse in distilled water. Discard polyethylene soil core liner and other disposable equipment in a plastic garbage bag.
11. Fill borehole with remaining soil cores and/or hydrated bentonite pellets. If sampling was conducted in a paved area, patch the surface with a like material.

## **STANDARD OPERATING PROCEDURE NO. 4**

### **Split-Spoon Sampling**

**Scope:** The operating procedure describes the ways and means of obtaining a soil sample from boring via a split-spoon sampler.

**Purpose:** The purpose of this procedure is to assure good quality control in field operations, uniformity between different field personnel and to allow traceability of possible cause of errors in analytical results.

**Equipment:** Split-spoon sampler, tape measure, hand lens, sample/core log, log book, sample containers with labels, chain-of-custody record, knife or trowel, disposable gloves and plastic sheeting

### **PROCEDURE:**

1. Place sheeting down near borehole.
2. Position split-spoon sampler over point to be sampled.
3. Hammer sampler as detailed in ASTM D 1586-84 "Penetration Test and Split-Barrel Sampling of Soils".
4. Count and record the number of blows required to penetrate 6 inches, 12 inches, 18 inches and 24 inches.
5. Remove the sampler and extract the sample. If VOA is to be conducted on the sample, immediately transfer it to a sample jar, leave no head space and tightly cap.
6. Examine and record sample description on sample/core log sheet in accordance with description procedure for the particular project. Make special note of any obviously contaminated zones.
7. Place sample in sample jar, label and record on Chain-of-Custody Record. Place in iced cooler.
8. Clean split-spoon sampler by dry brushing, followed by a Alconox solution wash, followed by a rinse in distilled water.



## **STANDARD OPERATING PROCEDURE NO. 5**

### **Geoprobe® Groundwater Sampling**

**Scope:** This operating procedure describes the ways and means of obtaining a groundwater sample from a Geoprobe® soil boring using a Geoprobe® Screen Point Sampler.

**Purpose:** The purpose of this procedure is to assure good quality control in field operations, uniformity between different field personnel and to allow traceability of possible cause of errors in analytical results.

**Equipment Needed:** Geoprobe® Screen Point Sampler, low-flow sampling equipment or mini bailer, water sampling log, log book, sample containers with labels, chain-of-custody record, disposable gloves, plastic sheeting, and decontamination equipment.

### **PROCEDURE:**

1. Place sheeting down near borehole.
2. Position Geoprobe® drive assembly over the point to be sampled.
3. With a drive cap installed on the Geoprobe® Screen Point Sampler, drive the sampler to one foot below targeted sampling depth.
4. Disengage the expandable drive point by pulling the rods back a distance of about two feet to expose screen.
5. Using a clean electronic water level indicator, gauge and record water level.
6. To collect sample:
  - Low-Flow Sampling - Refer to the standard operating procedure for Low-Flow Groundwater Sampling from Monitor Wells. Note: Due to the small diameter of the Geoprobe® Screen Point Sampler, Low-Flow sampling can only be achieved using tubing less than 3/4" diameter and a peristaltic pump.
  - Standard groundwater sampling – Refer to the standard operating procedures for Groundwater sampling from a monitor well. Note: Due to the small diameter of the Geoprobe® Screen Point Sampler, it is necessary to use tubing less than 3/4" diameter and a peristaltic pump or bail with a mini-bailer (3/4"x36").

## **STANDARD OPERATING PROCEDURE NO. 5**

### **Geoprobe® Groundwater Sampling (Cont.)**

7. Label sample containers, complete remaining information on field forms, and record information on a chain-of-custody record.
8. Store samples in coolers with ice at 4°C .
9. After sample collection has been completed, remove the Geoprobe® Screen Point Sampler from boring.
10. Decontaminate Geoprobe® Screen Point Sampler by dry brushing, followed by a Alconox solution wash, followed by a rinse in distilled water. Discard disposable equipment as appropriate.
11. Fill borehole with hydrated bentonite pellets. If sampling was conducted in a paved area, patch the surface with a like material.

## **STANDARD OPERATING PROCEDURE NO. 6**

### **Low-flow Groundwater Sampling from Monitoring Well**

**Scope:** This procedure describes the methodology for collecting representative groundwater samples for laboratory analyses from both open-borehole wells and unconsolidated aquifer-screened wells.

**Purpose:** The purpose of describing this procedure is to provide a uniform methodology for the collection of good quality and representative groundwater samples.

**Equipment Needed:** Personal protective equipment, field sampling forms, low-flow sampling pump, water filtering equipment, electronic water level meter, pH, temperature, turbidity, redox, dissolved oxygen, and conductivity meters, flow through cell, portable total ionizable presents meter (TIP), plastic trash bags, properly preserved and labeled sample containers, disposable polypropylene graduated beakers, and decontamination equipment.

### **PROCEDURE:**

1. Locate and identify the well to be sampled. Record pertinent information on appropriate sampling logs, including date, well identification number, weather, time, and samplers' initials.
2. Unlock protective casing and remove well cap. Position the TIP at wellhead upon opening well cap to detect emitted organic vapors. Select appropriate level of personal protection based on IDLHs and TLVs of pertinent chemicals. Refer to site HASP.
3. Calibrate all water quality meters.
4. Using a clean electronic water level indicator, gauge and record water level in well to determine placement of sample pump or tube intake.
5. Gently install pump or sampling tube in the well, placing the intake at or slightly above the middle of the screened interval (dependent on water level in well)
6. Connect low-flow cell to sample tubing.
7. Gauge and record water level in well, leaving the electronic water level meter in the well just above the water level.
8. Turn on sample pump to the lowest flow possible.

## **STANDARD OPERATING PROCEDURE NO. 6**

### **Low-flow Groundwater Sampling from Monitoring Well (Cont.)**

9. Gauge and record water level to determine drawdown in well. Note: The goal is to have a minimal drawdown less than .3 feet.
10. Measure and record flow rate (the recommended flow rate is < 0.5 liters per minute).
11. Adjust flow rate as necessary.
12. Check water quality indicator parameters: pH, conductivity, temperature, dissolved oxygen, redox potential, and turbidity.
13. Continue to check every 3 to 5 minutes: drawdown in well, flow rate, pH, conductivity, temperature, dissolved oxygen, redox potential, and turbidity.
14. Sample collection can be initiated after stabilization is achieved. Stabilization is achieved after all of the parameters have stabilized for 3 successive readings. (+/-0.1 for pH, +/-3% for conductivity, +/-10mv for redox potential, and +/-10% for turbidity and dissolved oxygen).
15. Disconnect tubing from the inlet of the flow through cell and proceed to fill sample containers. Begin with containers for volatile organics and continue with the remaining sample containers which require no filtering. If a filtered sample is required fit appropriate sized filter onto sample tube and fill container.
16. Complete remaining information on field forms.
17. Store samples in coolers with ice at 4°C.
18. Remove sample pump or sample tubing from well.
19. Decontaminate sample pump, flow through cell, and electronic water level meter. Discard disposable equipment in a plastic garbage bag.
20. Replace well cap and lock protective casing.

## **STANDARD OPERATING PROCEDURE NO. 7**

### **Surface Water Sampling from Surface Water Body**

- Scope: The operating procedure describes the ways and means of obtaining a surface water sample from a surface water body.
- Purpose: The purpose of this procedure is to assure good quality control in field operations, uniformity between different field personnel and to allow traceability of possible cause of errors in analytical results.
- Equipment: Sample log, log book, sample containers with labels, chain-of-custody record, disposable sample collection container, disposable gloves pH meter, conductivity meter, thermometer, and plastic sheeting

### **PROCEDURES**

1. Identify and locate the surface-water sampling location. Collect samples in a downstream to upstream order.
2. Approach sampling location from a downflow direction. Take special care within three to four feet of the actual sampling location so as not to disturb fine sands and silts that might affect analyses.
3. Record the sampling location, time, date, and other pertinent information on a water sampling log.
4. Immerse a clean polypropylene beaker in the center of the surface water body and allow it to partially fill with water. In large bodies of water, such as ponds or lakes, this may not be possible. In these cases, alternative methods must be considered.
5. Use the collected water to rinse the collection beaker and the samplers gloves. Immerse the beaker again for sample collection. If the volume obtained is not sufficient to fill all sample containers, portion aliquots into each container and submerge the beaker again for additional water until adequate water has been obtained to fill all sample containers.
6. Immerse the beaker a final time to collect enough water to perform appropriate field tests. Record on sample log: physical characteristics, pH, conductivity, and temperature.

## **STANDARD OPERATING PROCEDURE NO. 7**

### **Surface Water Sampling from Surface Water Body (Cont.)**

7. Discard the beaker, the gloves, and any other disposable equipment used to prevent cross contamination between sampling locations.
8. Prepare samples for shipment.

## **STANDARD OPERATING PROCEDURE NO. 8**

### **Filtration of Aqueous Samples**

**Scope:** The procedure describes the method for filtering aqueous samples to remove suspended particulate matter to allow for the analysis of dissolved metals.

**Purpose:** The activities covered by this procedure ensure quality control in the filtering of groundwater samples for analysis of dissolved metal and serve as a means to allow traceability of error(s) in procedures. Additionally, the method provides a uniform procedure, which eliminates variability between filtering personnel.

**Equipment:** Portable peristaltic pump, silicon tubing (approximately 6-inches per samples), Geotech dispos-a-filter<sup>™</sup> 0.45 micron disposable filter or equivalent, external battery/9 volt adaptor, appropriate sample containers, polyethylene tri-pour beaker sampling forms, and disposable polyvinyl chloride (PVC) gloves.

### **PROCEDURE:**

1. Obtain groundwater sample and fill appropriate volume in tri-pour beaker or appropriate clean, unpreserved laboratory sample bottle
2. Inspect the components of the pump, filter, tubing, and laboratory sample container for cleanliness, defects, and any possible need of repair.
3. Install clean, new silicon tubing into pump, making sure to use enough tubing to reach bottom of the tri-pour beaker.
4. Insert the inlet fitting of the disposable filter snugly into the silicon tubing extending from the left side of the pump.
5. Place the other end of the silicon tubing into the tri-pour beaker, making sure to keep the tubing suspended in the water and not allowing it to suck against the wall or bottom.
6. Place the outlet end of the filter over the opened laboratory sample container to be filled.
7. Switch the pump on. If the filter become clogged due to excess silt, additional filters may be used to complete the filtering of the sample.
8. Discard the filter and silicon tubing after completion of filtering process.

## **STANDARD OPERATING PROCEDURE NO. 9**

### **Sediment Sampling from Surface Water Body**

- Scope: The operating procedure describes the ways and means of obtaining a sediment sample from a surface water body using hand sampling apparatus.
- Purpose: The purpose of this procedure is to assure good quality control in field operations, uniformity between different field personnel and to allow traceability of possible cause of errors in analytical results.
- Equipment: Sediment sample log, log book, sample containers with labels, chain-of-custody record, 2" diam. by 6" length core sampler, disposable stainless steel core sampler liners, stainless steel bowl and trowel, sample container, disposable gloves and plastic sheeting

#### **PROCEDURE:**

1. Place sheeting down near sediment sampling location.
2. Install new stainless steel core sampler liner in core sampler.
3. Position core sampler over point to be sampled.
4. Advance sampler through water into sediment to desired depth (approximately 6-inches).
5. Remove the core sampler and extract the inner stainless steel liner containing the sample. Take care not to let the sample fall out of the end of the sampler by covering the end with hand, as necessary. Extrude sample from the core liner to a stainless steel bowl. If volatile organic analysis (VOA) is to be conducted on the sample, immediately transfer it to a sample jar, leave no head space and tightly cap.
6. Transfer remaining sample to bowl and homogenize with trowel. Place sample for other parameters into appropriate sample container.
7. Examine and record sample description on sample log sheet. Make special note of any obviously contaminated zones and sediment description.
8. Label sample containers and record on Chain-of-Custody Record. Place in iced cooler.



## **STANDARD OPERATING PROCEDURE NO. 9**

### **Sediment Sampling from Surface Water Body (Cont.)**

9. Decontaminate all non-dedicated sediment sampling equipment (e.g., core sampler, trowel, and bowl) by brushing in Micro solution wash, followed by a rinse in distilled water.

## STANDARD OPERATING PROCEDURE NO. 10

### Preparation of QA/QC Samples

Scope: This procedure outlines the methods that will be used when preparing quality control/quality assurance samples for chemical analyses in an analytical laboratory.

Purpose: The purpose of this procedure is to provide a uniform method of identifying and preparing representative QA/QC samples regardless of sampling personnel.

Equipment: Sampling logs (for cross-referencing documentation).

#### **PROCEDURE:**

1. QA/QC samples collected during a sampling event include one or more of the following:

Splits - Samples taken from the same volume of water or solid and sent to different analytical laboratories for similar analyses.

Rinse Blanks - Deionized water placed in contact with sampling devices after cleaning. The water is then collected in appropriately preserved containers and sent for analyses that will reflect the efficiency of cleaning techniques.

Trip Blanks - Laboratory prepared water in appropriately preserved containers which accompany sample bottles from time of shipment to the site until samples are sent back to the laboratory for analyses.

2. QA/QC samples are labeled accordingly unless specific procedures have been established for a given project:

Splits - Sample identification number

Trip Blanks - [mmddyy]TB-1,2,3, etc.,

Rinse Blanks - [mmddyy]RB-1,2,3, etc.,

## **STANDARD OPERATING PROCEDURE NO. 11**

### **pH Meter**

**Scope:** This procedure describes the calibration of a standard pH meter and the determination of pH in aqueous media.

**Purpose:** The purpose of this procedure is to provide a uniform basis for calibration of field pH meters and ensure continuity between field personnel. Additionally, the method provides quality control steps necessary for obtaining reliable and representative pH readings.

**Equipment:** pH meter, buffers, polypropylene beakers, paper towels, calibration logs, field logs, distilled water, thermometer, and extra batteries.

### **PROCEDURES:**

#### **Calibration**

1. Verify batteries are fully charged.
2. Turn meter on and allow it to stabilize for 3 to 5 minutes.
3. Select pH buffers 7, 4, and 10 and check temperatures of each. Record pertinent information on field calibration logs.
4. Place 10 ml. of each buffer in a pre-labeled container.
5. Clean pH probe with stream of distilled water.
6. Place probe in pH 7 buffer and stir gently.
7. Adjust temperature knob to read measured temperature and then adjust the calibration knob until 7.00 is displayed in the readout window.
8. Remove probe and clean with distilled water.
9. Place probe in second calibration buffer in the expected sample pH range (i.e., if sample is expected to be pH 6, use pH 4 buffer) and repeat calibration process.

## **STANDARD OPERATING PROCEDURE NO. 11**

### **pH Meter (Cont.)**

10. Remove probe, rinse with distilled water and check reading in the pH 7.00 buffer. If reading is off by more than 0.05 pH units recalibrate as described above.
11. Rinse probe and insert in groundwater sample. Record reading on appropriate field forms.
12. This calibration procedure should be performed:
  - Following significant ambient temperature changes;
  - When meter reads erratically or fails the single point calibration check;  
or
  - At beginning and end of sampling day use.
13. After approximately 10 readings, a single-point calibration check should be performed with pH Buffer 7. Record result on Field Instrument Calibration Form.

### **QA/QC REQUIREMENTS:**

Quadruplicate pH and temperature measurements are to be collected for each aqueous sample matrix at a frequency of 5% (i.e. 1 in 20 investigative measurements) or one per day, whichever is greater.

**NOTE:** In the event that the referenced equipment model is unavailable for use during sampling activities, comparable instruments or equipment will be operated per associated operator's instructions.

## **STANDARD OPERATING PROCEDURE NO. 12**

### **Measurement of Temperature for Aqueous Media**

Scope : This procedure describes the methods to be used for measuring the temperature of aqueous media while monitoring stabilization of parameters during well purging and during the sample collection process.

Purpose : The purpose of this procedure is to develop and maintain good quality in field operations and to create-uniformity between field personnel performing temperature measurements.

Equipment: Thermometer (or temperature probe on meter), log book, small beaker or sample jar, distilled water.

### **PROCEDURES**

1. Rinse thermometer or temperature probe with distilled water.
2. Pour sufficient amount of sample to cover probe tip into sample jar or beaker.
3. Place thermometer or temperature probe in sample.
4. Allow thermometer or temperature probe to equilibrate to the sample temperature (approximately 5-10 seconds).
5. Read and record temperature in log book or on appropriate field forms.
6. Rinse thermometer or temperature probe with distilled water.

## **STANDARD OPERATING PROCEDURE NO. 13**

### **Conductivity Meter**

**Scope:** This procedure describes the calibration and use of a portable field specific conductance meter for obtaining measurements in aqueous media.

**Purpose:** The purpose of this procedure is to provide a uniform means for calibration and operation of portable field specific conductance meters between field personnel. Additionally, the method provides quality control steps necessary for obtaining reliable and representative readings.

**Equipment:** Conductivity meter, reference solutions, polypropylene beaker, thermometer, distilled water

### **PROCEDURES:**

#### **Calibration**

1. Verify batteries are fully charged.
2. Turn meter on and allow it to stabilize for 3 to 5 minutes.
3. Determine the temperature of the reference solution.
4. Set temperature compensation knob on meter to temperature of reference solution.
5. Adjust standardized knob on meter to read value of reference solution.
6. Remove probe and rinse with distilled water. Blot dry the end of the probe.

#### **Operation:**

14. With instrument calibrated, set indicator knob to highest range.
15. Pour approximately 50 to 100 ml. of aqueous sample into a polypropylene beaker.
16. Clean conductivity probe with a stream of distilled or distilled water.

## **STANDARD OPERATING PROCEDURE NO. 13**

### **Conductivity Meter (Cont.)**

17. Measure the temperature of the sample and set temperature compensatory to the temperature of the sample.
18. Immerse probe in sample and stir gently.
19. Select appropriate scale range.
20. Record sample number, date, time, project, and resulting conductivity value on appropriate field logs.
21. Thoroughly rinse probe with stream of distilled or distilled water and then blot the probe dry.
22. This calibration procedure should be performed:
  - Approximately every 4 hrs of continual use
  - Following significant ambient temperature changes
  - When the meter reads erratically
  - At the beginning and end of sampling day use.
23. After approximately 10 readings, a single-point calibration check should be performed. Record result on Field Instrument Calibration Form.

### **QA/QC REQUIREMENTS:**

Quadruplicate SCON and temperature measurements are to be collected for each aqueous sample matrix at a frequency of 5% (i.e. 1 in 20 investigative measurements) or one per day, whichever is greater.

**NOTE:** In the event that the referenced equipment model is unavailable for use during sampling activities, comparable instruments or equipment will be operated per associated operator's instructions.

## **STANDARD OPERATING PROCEDURE NO. 14**

### **YSI 600XL Multi-Parameter Water Quality Monitor with YSI Model 610-D**

Scope: This procedure describes the calibration and use of the YSI 600XL Multi-Parameter Water Quality Monitor for obtaining measurements in aqueous media.

Purpose: The purpose of this procedure is to provide a uniform means for calibration and operation of the YSI 600XL Multi-Parameter Water Quality Monitor between field personnel. Additionally, the method provides quality control steps necessary for obtaining reliable and representative readings.

Equipment: YSI 600XL Multi-Parameter Water Quality Monitor, YSI 600XL Multi-Parameter Water Quality Monitor Instruction Manual, YSI Model 610-D hand held computer, YSI Model 610-D Operations Manual, YSI 5775 membrane kit, YSI 6570 maintenance kit, calibration log, groundwater parameter log, and reference solutions for calibration.

## **PROCEDURES**

### Calibration:

Follow manufacturer's calibration procedures for: pH, conductivity, dissolved oxygen, and redox potential. The YSI 600XL Multi-Parameter Water Quality Monitor Instruction Manual should always be kept with the calibration kit.

### Operation:

#### Down hole Operation:

1. Gauge and record water level in well.
2. Clean the YSI 600XL Multi-Parameter Water Quality Monitor and cord.
3. Slowly lower the YSI 600XL Multi-Parameter Water Quality Monitor into the well or sample container. For well measurement position probe in the middle of the screened interval. (Dependant on the water level in the well.)
4. Connect the YSI Model 610-D hand held computer to the YSI 600XL Multi-Parameter Water Quality Monitor.



## **STANDARD OPERATING PROCEDURE NO. 14**

### **YSI 600XL Multi-Parameter Water Quality Monitor with YSI Model 610-D (Cont.)**

5. Turn power on to the YSI Model 610-D hand held computer.
6. Select run mode from the menu. (Refer to YSI Model 610-D Operations Manual for detailed instruction)
7. Allow approximately 15 minutes for the parameters to stabilize. (stabilization is achieved when parameters remain stable for 30 seconds)
8. After stabilization has occurred record data on groundwater parameter log.
9. Review data (DO should not exceed 8-9 mg/L and a low DO ( $<1$  mg/L) is typically accompanied by a negative redox potential) Note: Dissolved oxygen charge must be between 25 – 75 for proper operation of the dissolved oxygen probe. (if out of range refer to Water Quality Monitor Instruction Manual for further instructions)
10. Remove YSI 600XL Multi-Parameter Water Quality Monitor from well or sample container and decon instrument.
11. To temporarily store the YSI 600XL Multi-Parameter Water Quality Monitor, immerse it in tap water in the storage/calibration bottle. Refer to Water Quality Monitor Instruction Manual for instructions on long term storage.
12. Complete the appropriate paperwork.
13. Close and secure well.

#### Flow through cell operation:

1. With tubing connected to cell, install YSI 600XL Multi-Parameter Water Quality Monitor and follow down hole steps 4-9
2. Complete the appropriate paperwork.
3. Remove YSI 600XL Multi-Parameter Water Quality Monitor from flow through cell and decon equipment.

## **STANDARD OPERATING PROCEDURE NO. 14**

### **YSI 600XL Multi-Parameter Water Quality Monitor with YSI Model 610-D (Cont.)**

4. To temporarily store the YSI 600XL Multi-Parameter Water Quality Monitor, immerse it in tap water in the storage/calibration bottle. Refer to Water Quality Monitor Instruction Manual for instructions on long term storage.

#### **QA/QC REQUIREMENTS:**

The YSI 600XL Multi-Parameter Water Quality Monitor should be calibrated according to the manufacturer's instructions each day against the appropriate reference solution. Standard solutions should be replaced every 6 months.

## **STANDARD OPERATING PROCEDURE NO. 15**

### **Oxidation/Reduction Potential (Eh) Meter**

Scope: This procedure describes the calibration and use of oxidation/reduction potential (REDOX) meter for obtaining measurements in aqueous media.

Purpose: The purpose of this procedure is to provide a uniform means for calibration and operation of REDOX meter between field personnel. Additionally, the method provides quality control steps necessary for obtaining reliable and representative readings.

Equipment: Eh meter, reference electrode, oxidation/reduction electrode, electrode assembly,

### **PROCEDURES:**

#### Calibration

1. Warm up meter.
2. Verify electrode sensitivity. Place a sample in a clean beaker, agitate, insert electrodes, and note Eh or millivolt (mV) reading. Add a small amount of diluted NaOH solution and note value of Eh. If the Eh drops sharply when NaOH is added (increase in pH), the electrodes are sensitive and operating properly. If the response is not appropriate, the polarity may be reversed or the electrodes may need recleaning.
3. Check response electrodes to the standard redox solutions. Rinse electrodes and sample beaker thoroughly with deionized water. Fill beaker with fresh redox standard solution and immerse electrodes. Following manufacturer's operating instructions, adjust meter to correct mV potential of the standard redox solution at appropriate temperature. (See Table 4 of ASTM Standard D 1498, page 266.) Repeat procedure with fresh standard without adjustments until two successive readings are constant. The readings should not differ from the mV value of the standard redox solution by more than 10 mV.

#### Operation

1. Wash electrodes thoroughly with deionized water.

## **STANDARD OPERATING PROCEDURE NO. 15**

### **Oxidation/Reduction Potential (Eh) Meter (Cont.)**

2. Place the sample in a clean beaker, or measure in-situ as appropriate. Agitate throughout measurement.
3. Read mV potential and record to nearest 10 mV.
4. Temperature, pH, and the type of electrode system used may also be recorded as necessary.
5. Electrode standardization may be checked periodically to two different pH's, measuring the Eh of the two redox reference quinhydrone solutions and comparing the values to those in Table 5 (ASTM Standard D 1498, page 266).
6. Record calibration and measurement data in logbook.

### **QA/QC REQUIREMENTS:**

The Oxidation/Reduction potential meter should be calibrated according to the manufacturer's instructions at the beginning of each day. See the manufacturer's operating instructions for care and maintenance instructions for the reference and redox electrodes.

## **STANDARD OPERATING PROCEDURE NO. 16**

### **Turbidity Meter**

- Scope:** This procedure describes the calibration and the use of a turbidity meter for obtaining measurements in aqueous media.
- Purpose:** The purpose of this procedure is to provide a uniform means for calibration and use of turbidity meters between field personnel. Additionally, the method provides quality control steps necessary for obtaining reliable and representative readings.
- Equipment:** Turbidity meter, reference solutions, calibration log, clean collection cup, and turbidity sample vials

### **PROCEDURES**

#### **Calibration**

1. Set range control knob to 0-20 NTU.
2. Insert clean reference standard into optical well and rotate standard until the minimum NTU is displayed.
3. Turn reference adjust control until display reads 0.02 NTU.
4. Record the result on the calibration log.

#### **Operation:**

1. Collect 50 to 500 ml of sample into a clean collection cup.
2. Allow the sample to equilibrate to ambient temperature for approximately 1 minute.
3. Pour the sample into the sample vial provided with the turbidity meter.
4. Rinse the vial with this water and then discard the water in the vial.
5. Fill the vial to the top by gently pouring additional sample into the vial. Avoid agitation of the sample during this process.

## STANDARD OPERATING PROCEDURE NO. 16

### Turbidity Meter (Cont.)

6. Cap the vial and wipe the outside of the vial with a clean absorbent wipe. Do not touch the sides of the vial as smudges or smears on the vial can result in inaccurate measurements.
7. Insert the sample vial into the optical well.
8. Check to be sure the vial is seated properly in the bottom of the optical well.
9. Place cap on top of the vial.
10. Wait 15 seconds.
11. Record the NTU value displayed. If the NTU value is greater than 200 NTU, record the value as ">200 NTU".
12. If the NTU reading is less than 5.0 NTU, recalibrate the meter with a 5.0 NTU standard and reanalyze the sample using the above procedure.
13. After NTU measurements are complete, discard sample and rinse sample vial with deionized water.

### **QA/QC REQUIREMENTS :**

The turbidity meter should be calibrated at the beginning of each day. Meter calibration should be checked with a standard solution every four hours. If the reading is greater than  $\pm 1$  NTU ( $> 2\%$ ) of standard, repeat calibration process. Quadruplicate NTU measurements are to be collected for each aqueous sample matrix at a frequency of 5% (i.e. 1 in 20 investigative measurements) or one per day, whichever is greater. The precision of the readings must be within  $\pm 10\%$ . Standard solution should be replaced in accordance with manufacturer recommendations.

## **STANDARD OPERATING PROCEDURE NO. 17**

### **Steam Cleaning**

Scope: This procedure describes approved steam cleaning techniques for decontaminating drilling augers, rods, well casings, and other miscellaneous equipment.

Purpose: The purpose of this procedure is to assure the representativeness of each boring or well by minimizing sources of potential contamination.

Equipment: (Usually provided by the drilling company) steam cleaner, pallets or racks, gloves, plastic sheeting

#### **PROCEDURES:**

1. Lay out the items to be decontaminated onto an elevated surface (pallets or rock) covered with polyethylene to avoid splash back from moist or wet sediments on the ground surface.
2. Remove large debris with a brush as necessary.
3. Spray items to be cleansed with the vapor from the steam cleaner until all soil particulates and visual chemical contaminants are removed. The cleaner, when fully operational, will produce a heavy spray of steam and water.
4. Rotate items as necessary using clean plastic gloves.
5. Handle all steam cleaned items with clean gloves and wrap in clean plastic sheeting or aluminum foil, as appropriate, during transportation and storing.
6. Avoid any contact with potential contaminants during handling or use.
7. If the item becomes contaminated during handling, repeat steps 1-5.

## **STANDARD OPERATING PROCEDURE NO. 18**

### **Decontamination of Split-Spoon Soil Samplers**

**Scope:** This procedure describes methodologies to be followed in split-spoon decontamination to ensure the representativeness of collected samples.

**Purpose:** The purpose of this procedure is to assure good quality control in the field and uniformity between different field personnel.

**Equipment:** Personal protective equipment, clean disposable gloves, wash brush, Alconox solution, 3 5-gallon buckets, distilled water.

#### **PROCEDURES:**

1. Break the split-spoon down into its individual pieces.
2. Initially cleanse each piece of the spoon by rinsing it in a bucket of potable water to remove heavy soils.
3. In a second bucket, wash the spoon with potable water and Alconox solution with a wash brush.
4. Rinse the spoon with methanol, if necessary.
5. Rinse the spoon in a third bucket containing potable water.
6. Reconstruct the spoon and make a final rinse with distilled water.



## **STANDARD OPERATING PROCEDURE NO. 19**

### **Monitoring Well Development**

- Scope :** This procedure describes the method to be followed for the development of monitoring wells placed in unconsolidated material.
- Purpose :** The purpose of outlining this procedures is to ensure that each monitoring well is properly developed so as to provide representative groundwater samples.
- Equipment:** Personal protective equipment, submersible or centrifugal pump, discharge or suction tubing, bailer with rope, generator, air compressor (dependant on method used), surge block arrangement, pH meter, conductivity meter, thermometer, turbidity meter, equipment for monitoring flow rate, disposable beaker, well development log, and arrangements for storage or disposal of development water.

### **PROCEDURES**

1. Begin development only after the well has been completed and the grout plug has cured for 24 hours.
2. Gauge and record water level, total depth of well, and depth from top of well casing to top of sediment inside well.
3. Calculate volume of water in well to determine minimum volume to be removed during development. Note: Minimum volume to be removed is 5 times the casing volume along with the stabilization of water quality parameters. For wells where the boring was made or enlarged with the use of drilling fluid, at least 5 times the measured amount of total fluids lost while drilling shall be removed.
4. Prepare well development log.
5. Calibrate pH, conductivity, and turbidity meter.
6. Methods available to remove water:
  - A. Pumping with a submersible pump –
    - 1) Using a clean, appropriately sized surge block, surge well in the area of the well screen. Water is alternately pushed out and then pulled in from the formation around the well by raising and lowering the surge block. Surge time will vary dependant on the local geology.

## **STANDARD OPERATING PROCEDURE NO. 19**

### **Monitoring Well Development (Cont.)**

- 2) Lower a clean submersible pump with accompanying discharge line and safety rope to a level 2-3 feet above bottom of the well.
- 3) Secure pump in well
- 4) Turn pump on.
- 5) Measure and record, at every calculated volume: pumping rate, pH, conductivity, temperature, and turbidity, describe physical characteristics of water.
- 6) Surge well as needed. Note: water should be removed throughout the column of water standing in the well by periodically lowering and raising the pump intake.

#### **B. Pumping with a centrifugal pump –**

- 1) Using a clean, appropriately sized surge block, surge well in the area of the well screen. Water is alternately pushed out and then pulled in from the formation around the well by raising and lowering the surge block. Surge time will vary dependant on the local geology.
- 2) Lower a clean appropriately sized suction tube 2-3 feet above bottom of the well and attach to the centrifugal pump. Pump should have a check valve installed on it to prevent back flow into the well.
- 3) Turn pump on.
- 4) Measure and record, at every calculated volume: pumping rate, pH, conductivity, temperature, and turbidity, describe physical characteristics of water.
- 5) Surge well as needed. Note: water should be removed throughout the column of water standing in the well by periodically lowering and raising the pump intake.

## **STANDARD OPERATING PROCEDURE NO. 19**

### **Monitoring Well Development (Cont.)**

#### **C. Bailer –**

- 1) Using a clean, appropriately sized surge block, surge well in the area of the well screen. Water is alternately pushed out and then pulled in from the formation around the well by raising and lowering the surge block. Surge time will vary dependant on the local geology.
- 2) Lower a clean bailer with clean rope and remove water. Surge bailer when lowering into the water to assist with sediment removal.
- 3) Measure and record, at every calculated volume: bailing rate, pH, conductivity, temperature, and turbidity, describe physical characteristics of water.
- 4) Surge well as needed. Note: water should be removed throughout the column of water standing in the well by periodically lowering and raising the bailer stopping point.

#### **D. Air Lift –**

- 1) Using a clean, appropriately sized surge block, surge well in the area of the well screen. Water is alternately pushed out and then pulled in from the formation around the well by raising and lowering the surge block. Surge time will vary dependant on the local geology.
  - 2) Lower cleaned tubing and air lines into well and begin to remove water using standard air lift practices.
  - 3) Measure and record, at every calculated volume: discharge rate, pH, conductivity, temperature, and turbidity, describe physical characteristics of water.
  - 4) Surge well as needed. Note: water should be removed throughout the column of water standing in the well by periodically lowering and raising the discharge tube.
7. Continue to develop well until water is clear and water quality parameters have stabilized. Stabilization is achieved after all parameters have stabilized for 3 successive readings. (+/-0.1 for pH, +/- 3% for conductivity, and +/- 10% for conductivity)

## **STANDARD OPERATING PROCEDURE NO. 19**

### **Monitoring Well Development (Cont.)**

8. Record quantity of water removed during development.
9. Remove all development materials and secure the well.
10. Decontaminate equipment and appropriately discard of disposable equipment.

## STANDARD OPERATING PROCEDURE NO. 20

### Calibration and Use of the Photoionization Detector

Scope: This procedure describes the methodology to be used for the calibration and use of the Photoionization Detector (PID) to detect volatile organic vapors.

Purpose: The purpose of this procedure is to have uniform calibration of the PID between field personnel so that documented readings will be representative on a day to day basis.

Equipment: PID, field calibration log, calibration gas (span gas), and other calibration equipment.

#### **PROCEDURE:**

1. Press POWER switch to turn on PID.
2. Unlock ZERO and SPAN controls by turning locking rings clockwise.
3. Set SPAN control to 5.
4. Allow PID I to sample clean air.
5. Adjust ZERO control until LCD reads 0.00.
6. Connect bag of Span Gas to PID inlet.
7. Adjust SPAN control until LCD indicates the Span Gas Concentration (usually 100 ppm). Disconnect Span Gas Bag.
8. Sample clean air again and readjust ZERO control until LCD reads 0.00, if necessary.
9. Lock ZERO control by turning locking ring counterclockwise.
10. Sample Span Gas again and readjust SPAN control until LCD indicates the Span Gas concentration, if necessary.
11. Lock SPAN control by turning locking ring counterclockwise. Disconnect Span Gas Bag.
12. Observe sample concentration changes on LCD. Concentration of total ionizables is displayed in Span Gas equivalent units.
13. Do not allow PID to draw in any liquid.
14. Press POWER switch after use to turn off PID.

## **STANDARD OPERATING PROCEDURE NO. 21**

### **Use of the Drager Multi-Gas Detector Pump**

**Scope:** This procedure describes the methodology to be used for the use of the Drager Gas Detector Pump to detect the presence of a known gas.

**Purpose:** The purpose of this procedure is to have uniform knowledge between field personnel so that documented readings will be representative on a day to day basis.

**Equipment Needed:** Drager Multi Gas Detector Pump and appropriate Drager Tube (Note: It is not permitted to combine these tubes with pumps of other manufacturers, since this may cause considerable indicating errors)

#### **PROCEDURE:**

1. Inspect Drager Multi Gas Detector Pump for proper operation and condition of rubber bellows. (To test for leaks: seal the pump with an unopened Drager Tube and completely compress the bellows. The pump is sufficiently air-tight if the bellows have not expanded again completely after 30 minutes.)
2. Check Drager Tube for the appropriate specifications and expiration date.
3. Carefully break off the both fused ends of the Drager Tube by inserting into the break-off eyelet at the top of the Drager Multi Gas Detector Pump and snapping.
4. Insert the opened Drager Tube into the Drager Multi Gas Detector Pump (the arrow must point towards the pump during the test).
5. Follow Tube Operating Instructions provided with the Drager Tube to determine the number of strokes needed for the color and intensity of the indicating layer to correspond to the comparison layer.
6. Draw the air sample through the tube by compressing the bellows completely and then releasing. (100cm<sup>3</sup> per stroke) Be sure to accurately count the number of strokes.
7. Refer to Tube Operating Instructions to evaluate results.
8. Appropriately discard spent tubes.

## **STANDARD OPERATING PROCEDURE NO. 22**

### **Water-Level Measurement in Monitoring Wells**

**Scope:** This procedure is applicable to the measurement of water levels in monitoring wells and open boreholes.

**Purpose:** The purpose of this procedure is to collect accurate and representative groundwater level measurements.

**Equipment Needed:** Electronic water level meter

#### **PROCEDURE:**

Water levels should always be recorded to  $\pm 0.01$ -foot. Measurements should be made from a marked point on the inner casing for monitoring wells and from the ground surface for open boreholes.

##### **A. Chalked-Tape Method**

1. Check records for historic water levels in the well, if available.
2. Rub the first 5 feet of a steel surveyor's chain or fiberglass tape with carpenter's chalk.
3. Lower the tape into the well until the end of the tape enters the water.
4. Record the tape footing at the wellhead to within 0.01 feet.
5. Pull the tape out of the well and read the tape footage of the water mark to within 0.01 feet. The difference between the readings is the water level.

##### **B. Sounding**

1. Attach a small float or hollow-bottom weight or sounder to the end of a tape measure.
2. Lower the sounder into the well and listen for the sound of the weight hitting the water surface.
3. When this is heard, pull the sounder back a few inches and redrop it by 1/4-inch increments until the sound is heard again.
4. Subsequent smaller increments of lowering the sounder will allow water-level measurements to within 0.01 feet.

## STANDARD OPERATING PROCEDURE NO. 22

### Water-Level Measurement in Monitoring Wells (Cont.)

5. Measure the length from the zero mark on the tape measure to the bottom of the weight. Add this value to all field measurements made with the sounder.

#### C. Electric-Water Level Meter (Solinst)

1. Turn the Solinst on by turning the knob clockwise. This knob is also the volume control. Test the Solinst to see if the battery is dead by pushing the button next to the volume knob. If the battery is charged, the Solinst will emit an audible tone and the red indicator light will illuminate.
2. Lower the end of the probe into the well or borehole. The probe will cause the unit to emit the tone and illuminate the light when it contacts water.
3. Pull the probe back a few inches and lower the probe in smaller increments until the water level is measured to within 0.01 feet.
4. The water level is read directly from the Solinst tape, and already includes a correction for the length of the probe on the bottom of the tape.

#### D. Interface Probe: This is the only reliable method for wells with floating free product.

1. Push the On/Off button to turn unit on. Lower the probe into the liquid. The horn will sound a steady tone and the yellow light will illuminate when the probe contacts an oil product. Slowly raise probe until sound stops, lower until sound is heard again to refine the oil level.
2. Read the tape marking and note as the surface level of product.
3. Slowly lower the probe through the oil product, searching for the oil-water interface. When the probe reaches water, the tone will switch from steady to a beeping tone and the red light will illuminate. Slowly move probe up and down to refine the oil/water interface to within 0.01 feet. Read the water level directly from the tape. The length of the probe is already considered.

**NOTE: Auto Shutoff Feature:** After approximately 5 minutes of power on, the unit will auto-shut off. A chirping sound will be heard, warning impending shut off. Press <POWER ON/RENEW> to continue operation. During five minute interval, short "alive" beep is heard.



## **STANDARD OPERATING PROCEDURE NO. 22**

### **Water-Level Measurement in Monitoring Wells (Cont.)**

#### **E. Precautions and Common Problems:**

1. Be sure to allow sufficient time after development, purging or pumping to allow the well to recover to static conditions.
2. Sounding may be difficult with very deep water levels or in noisy conditions because the sound is hard to hear.
3. Measurement of water levels in pumping wells or wells/boreholes with cascading water can be difficult. Installing a narrow PVC access tube inside the well casing can make obtaining accurate readings easier.
4. Free product floating on the water table depresses the natural water level. If a true water level is required, the product of the oil thickness and the oil specific gravity must be added to the oil/water interface elevation.
5. If there is no measurement mark on the well riser, add one in indelible ink.

## **APPENDIX F**

### **FIELD FORMS**

- F1 – Field Instrument Calibration Form**
- F2 – Field Boring Log**
- F3 – Monitoring Well Construction Log**
- F4 – Groundwater Sampling Form**
- F5 – Surface Water/Sediment Sample Log**
- F6 – Surface Soil Sampling Log**
- F7 – Water Level Field Log**
- F8 – Monitoring Well Development Log**
- F9 – Quality Assurance Sample Field Log**
- F10 – Daily Field Activity Log**
- F11 – Pump Test Log**

Time of Initial Calibration \_\_\_\_\_ Weather \_\_\_\_\_

[illegible]

## FIELD BORING LOG

Boring Number		Boring Location			Sheet No. ____ of ____	
Drilling Method					Field Geologist	
					Surface Elevation	
Project Name					Project	
					Date Started	
					Date Completed	
Depth (ft)	Lab Sample	Sample Recovery (ft)	Blow Counts (blows/6")	Hnu ppm	Material Description	Comments

Field Conditions (weather, etc.) \_\_\_\_\_

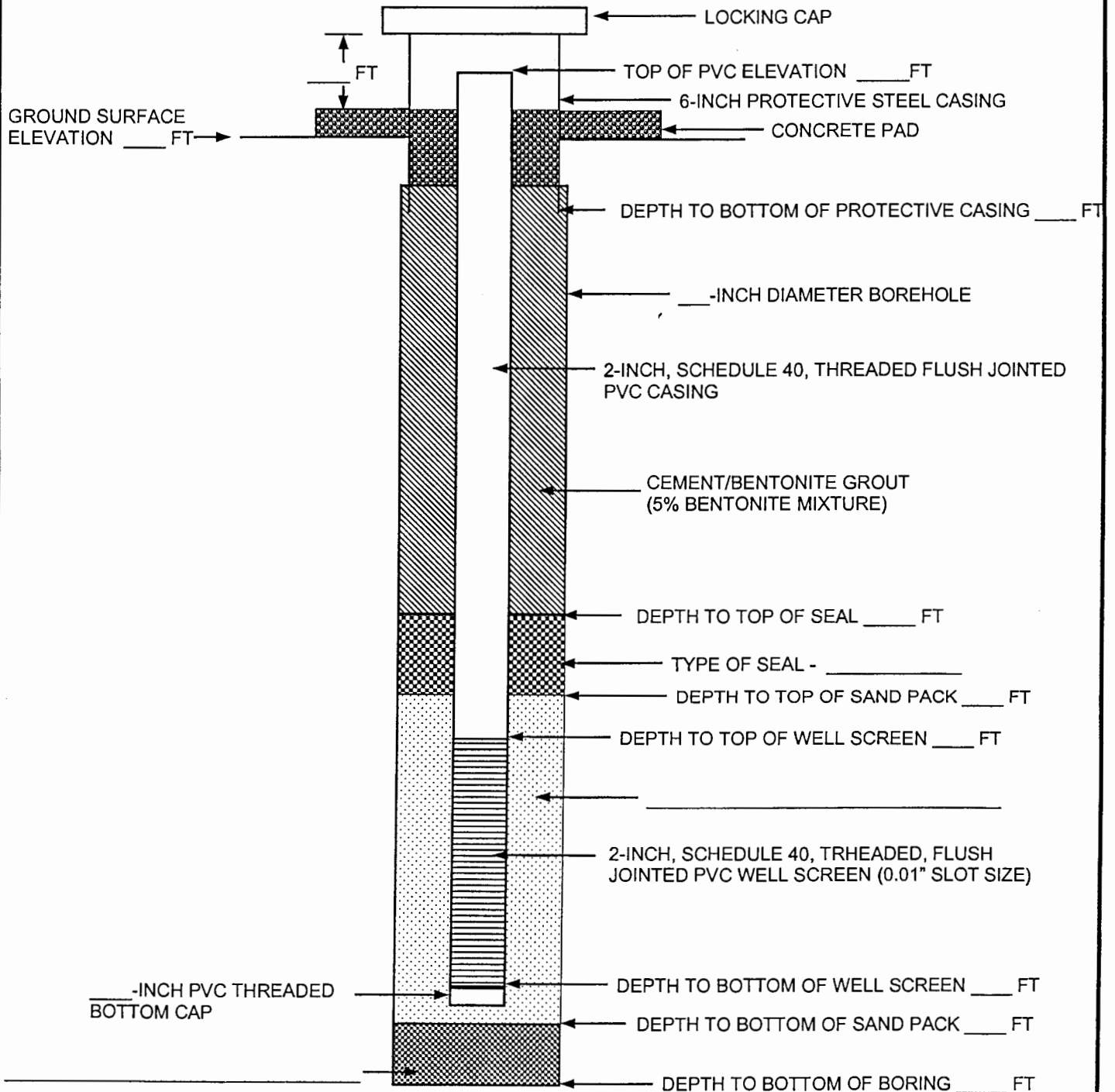
\_\_\_\_\_

Comments \_\_\_\_\_

\_\_\_\_\_

# MONITORING WELL CONSTRUCTION LOG

MONITORING WELL NUMBER	MONITORING WELL LOCATION	
SOIL BORING NUMBER	FIELD GEOLOGIST	DATE STARTED
PROJECT NAME	DRILLER	DATE COMPLETED
PROJECT NUMBER	DRILLING METHOD	DEVELOPMENT METHOD



COMMENTS: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

PROJECT No.:

PERSONNEL:

PAGE \_\_\_\_ OF \_\_\_\_

[illegible]

CIVIL & ENVIRONMENTAL CONSULTANTS, INC. PITTSBURGH, PA

## SURFACE WATER/SEDIMENT SAMPLE LOG SHEET

[illegible]

# SURFACE SOIL SAMPLE LOG SHEET

[illegible]



## GROUNDWATER LEVEL FIELD LOG

[illegible]

# WELL DEVELOPMENT LOG

Project Name \_\_\_\_\_

Project Number \_\_\_\_\_

Well Number

Location \_\_\_\_\_

## Development Method

Developed By \_\_\_\_\_

[illegible]

**NOTE: Well development is considered complete when three consecutive turbidity measurements are within 10 percent of one another.**

## QUALITY ASSURANCE SAMPLE LOG SHEET

[illegible]

Facility Name	Project Number	Date
Persons On-Site		
Weather Conditions		

[illegible]

# PUMP-TEST LOG

Site Name:				Project #:		Page ____ of ____	
Startup Date and Time:				Personnel:			
Pumping Well:				Pump Setting:			
Observation Wells				Pumping Setup:			
Well	Distance from Pumping Well	Well	Distance from Pumping Well				

			Discharge Measurements			
Date	Clock Time	Elapsed Time	Volume ( )	Time ( )	Rate ( )	Comments/Events
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						

### PUMP TEST DATA

#### OBSERVATION AND CORRECTION WELLS

[illegible]

## **APPENDIX G**

### **CONSTITUENT PQLS VERSUS RISK-BASED SCREEN LEVELS**

Pace Analytical Services, Inc.  
Volatile Organic Compounds Appendix G; EPA Method 8260B  
Wheeling Pittsburgh Steel Corporation  
Steubenville East Coke Plant  
Follansbee, WV  
Revised September 2003

Constituent	PQL Aqueous ug/l	MDL Aqueous ug/l	Tap Water RBC's ug/l	Primary MCL ug/l	PQL Solid ug/kg	MDL Solid ug/kg	Residential RBC's mg/kg
Acetonitrile	25	0.37	120	-	- (1)	- (1)	-
Acrolein	25	1.86	0.042	-	25	1.40	1600
Chloromethane	1	0.17	190	-	5	0.19	-
Bromomethane	1	0.54	8.5	-	5	0.12	110
Vinyl Chloride	2	0.54	0.015	2	5	0.10	0.09
Chloroethane	1	0.20	3.6	-	5	0.47	220
Methylene Chloride	1	0.20	4.1	-	5	0.12	0.85
Acetone	10	0.69	610	-	10	7.80	7800
Carbon Disulfide	5	0.22	1000	-	5	0.10	7800
1,1-Dichloroethene	1	0.19	350	7	5	0.14	3900
1,1-Dichloroethane	1	0.16	800	-	5	0.22	7800
1,2-Dichloroethene (total) reported as							
cis-1,2-Dichloroethene	1	0.19	61	70	5	0.13	780
trans-1,2-Dichloroethene	1	0.16	12	100	5	0.09	1600
Chloroform	1	0.15	15	-	5	0.05	780
1,2-Dichloroethane	1	0.12	12	5	5	0.09	7
2-Butanone	10	0.25	1900	-	10	0.20	47000
Bromochloromethane	1	0.24	-	-	5	0.28	-
1,1,1-Trichloroethane	1	0.15	3200	200	5	0.20	22000
Carbon tetrachloride	1	0.24	0.16	5	5	0.08	4.9
1,2-Dichloropropane	1	0.15	0.16	5	5	0.12	9.4
cis-1,3-Dichloropropene	1	0.14	-	-	5	0.03	-
Trichloroethene	1	0.20	0.026	5	5	0.26	1.6
Dibromochloromethane	1	0.24	0.13	-	5	0.09	7.6
1,1,2-Trichloroethane	1	0.23	0.19	3	5	0.13	11
Benzene	1	0.12	0.34	5	5	0.06	12
trans-1,3-Dichloropropene	1	0.17	-	-	5	0.11	-
Bromoform	1	0.42	8.5	-	5	0.16	81
4-Methyl-2-pentanone (MIBK)	10	0.14	2000	-	10	0.09	6300
2-Hexanone	10	0.21	1500	-	10	0.19	3100
Tetrachloroethene	1	0.24	0.53	5	5	0.30	32
Toluene	1	0.16	750	1000	5	0.08	16000
1,1,2,2-Tetrachloroethane	1	0.20	0.053	-	5	0.07	3.2
Chlorobenzene	1	0.10	110	100	5	0.07	1600
Ethylbenzene	1	0.15	1300	700	5	0.11	7800
Styrene	1	0.12	1600	100	5	0.03	16000
Xylenes (total)	1	0.37	210	10000	5	0.23	16000

(1) MDL is not current for this parameter/matrix

MDL values are taken from EPA Tables dated 4/25/2003



Pace Analytical Services, Inc.  
Semivolatile Organic Compounds Appendix G; EPA Method 8270C  
Wheeling Pittsburgh Steel Corporation  
Steubenville East Coke Plant  
Follansbee, WV  
Revised September 2003

Constituent	PQL Aqueous ug/l	MDL Aqueous ug/l	Tap Water RBC's ug/l	Primary MCL ug/l	PQL Solid ug/kg	MDL Solid ug/kg	Residential RBC's mg/kg
Acenaphthene	10	1.40	370	-	330	162.3	4700
Acenaphthylene	10	0.47	-	-	330	131.5	-
Acetophenone	10	0.45	0.042	-	500	400	7800
Aniline	10	0.45	12	-	330	118.3	110
Anthracene	10	0.41	1800	-	330	47.9	23000
Benzo(a)anthracene	10	0.24	0.092	-	330	46.5	0.87
Benzo(b)fluoranthene	10	0.28	0.092	-	330	59.2	0.87
Benzo(k)fluoranthene	10	0.27	0.92	-	330	45.6	8.7
Benzo(g,h,i)perylene	10	0.22	-	-	330	46.7	-
Benzo(a)pyrene	10	0.21	0.0092	0.2	330	28.3	0.087
bis(2-Chloroethoxy)methane	10	0.53	-	-	330	186.8	-
bis(2-chloroethyl)ether	10	0.48	0.0096	-	330	159.9	0.58
bis(2-chloroisopropyl)ether	10	0.48	0.26	-	330	148.7	9.1
bis(2-ethylhexyl)phthalate	10	0.37	4.8	-	330	44.2	46
Bromophenyl phenyl ether	10	0.43	-	-	330	92.3	-
Butylbenzyl phthalate	10	0.32	7300	-	330	48.2	16000
4-Chloroaniline	10	0.94	150	-	330	227.2	310
4-Chloro-3-methylphenol	10	0.96	-	-	330	301.2	-
2-Chloronaphthalene	10	0.58	-	-	330	217.5	-
2-Chlorophenol	10	0.89	30	-	330	305.7	390
4-Chloro phenyl ether	10	0.48	-	-	330	155.2	-
Chrysene	10	0.23	9.2	-	330	52.5	87
Dibenzofuran	10	0.49	12	-	330	150.8	160
di-n-Butylphthalate	10	0.51	3700	-	330	49.5	7800
Dibenz(a,h) anthracene	10	0.22	0.0092	-	330	59.1	0.087
1,2-Dichlorobenzene	10	0.45	270	600	330	179.6	7000
1,3-Dichlorobenzene	10	0.43	180	-	330	170.2	2300
1,4-Dichlorobenzene	10	0.45	0.47	75	330	176.4	27
3,3'-Dichlorobenzidine	10	0.48	0.15	-	330	88.2	1.4
2,4-Dichlorophenol	10	0.94	110	-	330	336.1	230
Diethylphthalate	10	0.50	29000	-	330	62.4	63000
2,4-Dimethylphenol	10	1.48	730	-	330	405.3	1600
Dimethylphthalate	10	0.54	370000	-	330	94.4	780000
4,6-Dinitro-2-methylphenol	20	0.69	3.7	-	830	101.6	7.8

RBC values are taken from EPA Tables dated 4/25/2003

Pace Analytical Services, Inc.  
Semivolatile Organic Compounds Appendix G; EPA Method 8270C  
Wheeling Pittsburgh Steel Corporation  
Steubenville East Coke Plant  
Follansbee, WV  
Revised September 2003

Constituent	PQL Aqueous ug/l	MDL Aqueous ug/l	Tap Water RBC's ug/l	Primary MCL ug/l	PQL Solid ug/kg	MDL Solid mg/kg	Residential RBC's mg/kg
2,4-Dinitrophenol	20	0.65	73	-	830	131.9	160
2,4-Dinitrotoluene	10	0.44	73	-	330	49.8	160
2,6-Dinitrotoluene	10	0.52	37	-	330	126.6	78
Di-n-octylphthalate	10	0.25	730	-	330	51.1	1600
Fluoranthene	10	0.31	1500	-	330	52	3100
Fluorene	10	0.49	240	-	330	140.8	3100
Hexachlorobenzene	10	0.45	0.042	1	330	81.8	0.4
Hexachlorobutadiene	10	0.50	0.86	-	330	207.2	8.2
Hexachlorocyclopentadiene	10	0.37	220	50	330	43.4	470
Hexachloroethane	10	0.45	4.8	-	330	182	46
Ideno(1,2,3-c,d)pyrene	10	0.24	0.092	-	330	5	0.87
Isophorone	10	0.50	70	-	330	139	670
2-Methylnaphthalene	10	0.46	120	-	330	171.6	1600
2-Methylphenol	10	81	1800	-	330	275.7	3900
4-Methylphenol	10	1.09	180	-	330	368.5	390
Naphthalene	10	0.46	6.5	-	330	175.4	1600
2-Nitroaniline	20	1.07	-	-	830	133.8	-
3-Nitroaniline	20	1.63	3.3	-	830	79.4	23
4-Nitroaniline	20	0.73	3.3	-	830	69.1	32
Nitrobenzene	10	0.47	3.5	-	330	175.9	39
2-Nitrophenol	10	0.87	-	-	330	376.5	-
4-Nitrophenol	20	0.13	290	-	830	119.1	630
n-Nitrosodiphenylamine	10	0.86	14	-	330	193	130
n-Nitrosodipropylamine	10	0.48	0.0096	-	330	118	0.091
Pentachlorophenol	20	0.66	0.56	1	830	78.8	53
Phenanthrene	10	0.43	-	-	330	48	-
Phenol	10	0.40	11000	-	330	267.6	23000
Pyrene	10	0.30	180	-	330	48.2	2300
Pyridine	10	1.27	37	-	330	441.5	78
2,4,5-Trichlorophenol	20	1.07	3700	-	830	290	7800
2,4,6-Trichlorophenol	10	1.00	6.1	-	330	315.5	58

RBC values are taken from EPA Tables dated 4/25/2003

Pace Analytical Services, Inc.  
Inorganic Compounds Appendix G  
Wheeling Pittsburgh Steel Corporation  
Steubenville East Coke Plant  
Follansbee, WV  
Revised September 2003

Constituent	PQL Aqueous ug/l	IDL Aqueous ug/l	Tap Water RBC's ug/l	Primary MCL ug/l	PQL Solid mg/kg	IDL Solid mg/kg	Residential RBC's mg/kg
Aluminum	50	7.94	37000	-	10	0.794	78000
Antimony	5	2.75	15	6	0.5	0.275	31
Arsenic	5	4.19	0.045	10 (1)	0.5	0.419	0.43
Barium	10	0.15	2600	2000	2	0.015	5500
Beryllium	1	0.11	73	4	0.2	0.011	160
Cadmium	1	0.29	18	5	0.2	0.029	39
Calcium	100	12.35	-	-	200	1.235	-
Chromium	5	0.43	-	100	0.5	0.043	-
Cobalt	6	0.85	730	-	0.6	0.085	1600
Copper	5	0.38	1500	1300 (2)	1	0.038	3100
Iron	50	12.5	11000	-	5	1.25	23000
Lead	2	1.39	-	15 (2)	0.5	0.139	-
Magnesium	200	9.51	-	-	50	0.951	-
Manganese	5	0.22	730	-	1	0.022	1600
Mercury	0.2	0.05	-	2	0.1	0.005	-
Molybdenum	15	1.55	180	-	1.5	0.155	390
Nickel	10	0.97	730	-	2	0.097	1600
Potassium	500	12.56	-	-	100	1.256	-
Selenium	5	5.39	180	50	0.5	0.539	390
Silver	1	0.36	180	-	0.2	0.036	390
Sodium	1000	230.98	-	-	500	23.098	-
Thallium	10	5.12	2.6	5	2	0.512	5.5
Vanadium	5	0.49	260	-	1	0.049	550
Zinc	10	0.65	11000	-	1	0.065	23000

All analytes will be analyzed by EPA Method 6010B, except Mercury, which will be analyzed by EPA Method 7470A/7471A

(1) as of 1/23/06

(2) action level

RBC values are taken from EPA Tables dated 4/25/2003

Pace Analytical Services, Inc.  
Semivolatile Organic Compounds Appendix G; EPA Method 8310  
Wheeling Pittsburgh Steel Corporation  
Steubenville East Coke Plant  
Follansbee, WV  
Revised September 2003

Constituent	PQL Aqueous ug/l	MDL Aqueous ug/l	Tap Water RBC's ug/l	Primary MCL ug/l	PQL Solid ug/kg	MDL Solid ug/kg	Residential RBC's mg/kg
Acenaphthene	2.5	0.49	370	-	100	6.18	4700
Acenaphthylene	2.5	1.28	-	-	100	4.83	-
Anthracene	0.2	0.01	1800	-	15	0.23	23000
Benzo(a)anthracene	0.2	0.01	0.092	-	15	0.93	0.87
Benzo(b)fluoranthene	0.2	0.02	0.092	-	15	1.25	0.87
Benzo(k)fluoranthene	0.2	0.04	0.92	-	15	4.25	8.7
Benzo(g,h,i)perylene	0.2	0.02	-	-	15	1.55	-
Benzo(a)pyrene	0.2	0.01	0.0092	0.2	15	1.77	0.087
Chrysene	0.2	0.01	9.2	-	15	0.91	87
Dibenz(a,h) anthracene	0.2	0.07	0.0092	-	15	2.84	0.087
Fluoranthene	0.2	0.04	1500	-	15	2.1	3100
Fluorene	0.2	0.02	240	-	15	1.82	3100
Ideno(1,2,3-c,d)pyrene	0.2	0.02	0.092	-	15	4.97	0.87
2-Methylnaphthalene	2.5	- (1)	120	-	100	- (1)	1600
1-phthalene	2.5	1.03	6.5	-	100	6.47	1600
Phenanthrene	0.2	0.04	-	-	15	0.97	-
Pyrene	0.2	0.03	180	-	15	3.53	2300

RBC values are taken from EPA Tables dated 4/25/2003

(1) MDL is not current for this parameter/matrix